

Attachment 1

In response to this FOIA request, EPA is providing the current, existing EPA published quality criteria guidance for states and authorized tribes to consider when developing water quality standards for dissolved oxygen. This guidance was published in the 1986 EPA document entitled, "Quality Criteria for Water" also known as "the Gold Book" (EPA 440/5-86-001), available at

http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/upload/2009_01_13_criteria_goldbook.pdf) and contains a Table 1 on page 211 the provides the following criteria guidance values for States and authorized tribes to consider when developing water quality standards for dissolved oxygen.

Table 1. Water quality criteria for ambient dissolved oxygen concentration (mg/L).

	Coldwater Criteria		Warmwater Criteria	
	Early Life Stages ^{1,2}	Other Life Stages	Early Life Stages ²	Other Life Stages
30 Day Mean	NA	6.5	NA	5.0
7 Day Mean	9.5 (6.5)	NA	6.0	NA
7 Day Mean Minimum	NA	5.0	NA	4.0
1 Day Minimum	8.0 (5.0)	4.0	5.0	3.0

In the table above, italicized values are water column values to insure (intergravel DO concentrations) for early lifestages of coldwater species. For species that have early life stages exposed directly to the water column, the figure in the parentheses apply. The guidance notes that all minima should be considered as instantaneous concentrations to be achieved at all times. The document also discussed further restrictions that apply to highly manipulatable discharges.

These dissolved oxygen criteria magnitude, frequency, and duration elements reflect the best science available at the time. In addition to the recommended values in the "Gold Book", the EPA also included information that could be used by states reflecting the state of knowledge at the time regarding dissolved oxygen dynamics and the potential for impacts on aquatic life.

The Gold Book guidance also states "A daily minimum has been included to make certain that no acute mortality of sensitive species occurs as a result of lack of oxygen. Because repeated exposure to dissolved oxygen concentrations at or near the acute lethal threshold will be stressful and because stress can indirectly produce mortality or other adverse effects (e.g., through disease), the criteria are designed to prevent significant episodes of continuous or regularly recurring exposures to dissolved oxygen concentrations at or near the lethal threshold, by the use of a 7-day averaging period for early life stages, by stipulating a 7-day mean minimum value for other life stages, and by recommending additional limits for manipulatable discharges."

EPA's 1986 Gold Book (pp. 216-217) criteria also provided information for states and authorized tribes to consider regarding monitoring of dissolved oxygen and potential

interpretation of dissolved oxygen data, which is relevant for consideration of the potential impacts of diurnal variation in DO related to this FOIA request

“The acceptable mean concentrations should be attained most of the time, but some deviation below these values would probably not cause significant harm. Deviations below the mean will probably be serially correlated and hence apt to occur on consecutive days. The significance of deviations below the mean will depend on whether they occur continuously or in daily cycles, the former being more adverse than the latter. Current knowledge regarding such deviations is limited primarily to laboratory growth experiments and by extrapolation to other activity related phenomena.”

“Under conditions where large daily cycles of dissolved oxygen occur, it is possible to meet the criteria mean values and consistently violate the mean minimum criteria. Under these conditions the mean minimum criteria will clearly be the limiting regulation unless alternatives such as nutrient control can dampen the daily cycles.” (underlining added)

“The significance of conditions which fail to meet the recommended dissolved oxygen criteria depend largely upon five factors: (1) the duration of the event; (2) the magnitude of the dissolved oxygen depression; (3) the frequency of recurrence; (4) the proportional area of the site failing to meet the criteria, and (5) the biological significance of the site where the event occurs. Evaluation of an event's significance must be largely case- and site-specific. Common sense would dictate that the magnitude of the depression would be the single most important factor in general, especially if the acute value is violated”.

“A logical extension of these considerations is that the event must be considered in the context of the level of resolution of the monitoring or modeling effort. Evaluating the extent, duration, and magnitude of an event must be a function of the spatial and temporal frequency of the data. Thus, a single deviation below the criterion takes on considerably less significance where continuous monitoring occurs than where sampling is comprised of once-a-week grab samples. This is so because based on continuous monitoring the event is provably small, but with the much less frequent sampling the event is probably not small and can be considerably worse than indicated by the sample. The frequency of recurrence is of considerable interest to those modeling dissolved oxygen concentrations because the return period, or period between recurrences, is a primary modeling consideration contingent upon probabilities of receiving water volumes, waste loads, temperatures, etc. It should be apparent that return period cannot be isolated from the other four factors discussed above. Ultimately, the question of return period may be decided on a site-specific basis taking into account the other factors (duration, magnitude, areal extent, and biological significance) mentioned above. Future studies of temporal patterns of dissolved oxygen concentrations, both within and between years, must be conducted to provide a better basis for selection of the appropriate return period.” (underlining added). The Gold Book identifies the 5 factors above as important in identifying the significance of conditions in situations where a Dissolved Oxygen criteria are not met.